

**THE LIMITS OF THE DIPTEROUS GROUP CALYPTRATA  
(CYCLORRHAPHA).**

BY J. R. MALLOCH, Urbana, Ill.

In connection with some work I have been doing on cyclorhaphous Diptera I have been forced to decide upon characters which will enable students to separate the calyptrate and acalyptrate forms with more certainty, less trouble and experience, and a nearer approach to a natural arrangement than is possible by using any existing textbook. Practically all the writers who attempt to deal with the matter base their separation of the groups upon the comparative size of the calyptra, the calyptrata being said to have large calyptra while the acalyptrata have these organs very small or absent. In the case of the Tachinidæ and the other highly specialized forms the very large calyptra readily distinguish these insects, but many of the genera in Anthomyiidæ and especially in Scatophagidæ have the calyptra very small and such forms cannot be distinguished from acalyptrates by the size of these organs. It is thus impossible to use this character for distinguishing the two groups, and as a matter of fact in practice it either misleads the student or leaves him in doubt as to which group his species belongs to. Some recent writers have tried to make clearer, by elaboration, the distinguishing characteristics of the groups, but as all of them have persisted in placing the Scatophagidæ in the acalyptrates such attempts have been invariably unsuccessful.

It is my opinion that in order to be appropriately applicable to groups of the status of these two in all cases the differentiating medium should consist of one or very few characters which should be, not of a comparative nature, but more or less intimately associated with the biological characteristics of the groups and in a definite manner indicate evolutionary relationships—*i. e.*, the character (structure, usually external) should be one which is either present or absent, or the position of which differs strikingly in the two groups.

In other words the character or characters should clearly indicate natural affinities, be readily appreciable even to students

who are not conversant with the species as a whole, and give as little latitude as possible to individual opinion, so reducing probability of error to a minimum.

The standard indicated is a rather high one and undoubtedly very difficult of attainment, but in the case under consideration it is possible by the use of one character to separate nearly all of the calyptrates, including Scatophagidæ, from the other cyclorhaphous Diptera. This differentiating character is the position of the abdominal spiracles. In the calyptrates these are situated in the tergites, while in the acalyptates they are situated in the conjunctiva, or membrane between the tergites and the sternites. There are very few exceptions to this rule, those in the former group being present, so far as I know at present, in Gastrophilinae, and a few males in the Scatophagidæ and Fanniinae, while in the acalyptates the exceptions are met with in some genera of Ephydridæ and in a few species of *Dryomyza*. The second antennal joint of all calyptrates has a longitudinal split on its upper outer surface which usually extends to or nearly to the base, a feature rarely present in any of the higher acalyptates. Accessory characters for the differentiation of the groups are found in the venation of the wings, and the tibial armature. The outstanding fact developed by accepting the tergal spiracles as the differentiating medium is that the Scatophagidæ belong to the calyptrate series, a conclusion which is borne out by their larval characters.

That the position of the abdominal spiracles is of primary importance in classifying mature insects is beyond question, as may be proven by an examination of forms belonging to the various orders, the most generalized forms having them situated in the sternites, while the most specialized have them in the tergites. A striking instance of this specialization is seen in the family Cyrtidæ, the larvæ of which live as internal parasites in spiders, where the species have so far I have seen tergal spiracles, the other Brachycera examined by me having the spiracles in the conjunctiva.